CLAIMS

What is claimed is:

1. A speaker device for emitting subsonic, sonic or ultrasonic compression waves, said device being comprised of:

a rigid emitter plate having an outer face oriented outward and an inner face, said emitter plate having a plurality of apertures extending between the outer and inner faces;

a thin piezoelectric film disposed across the apertures of the emitter plate;

electrical contact means coupled to the piezoelectric film for providing an applied electrical input; and

pressure means coupled to the emitter plate for developing a biasing pressure with respect to the thin film at the apertures to distend the film into an arcuate emitter configuration capable of constricting and extending in response to variations in the applied electrical input at the piezoelectric film to thereby create a compression wave in a surrounding environment.

2. The speaker device as in claim 1 further comprising a thin polymer coating on the piezoelectric film, wherein the thin polymer coating seals the piezoelectric film and prevents pressure leakage.

3. The speaker device as in claim 2 wherein the thin polymer coating is polyvinylidelene chloride.

4. The speaker device as in claim 1 further comprising a heavy inert gas in the pressure means, wherein the heavy inert gas reduces gas leakage through the piezoelectric film.

5. The speaker device as in claim 4 wherein the heavy inert gas is nitrogen.

6. The speaker device as in claim 1 wherein the apertures have a center and the apertures are spaced apart 1/4 to 1/2 of a wavelength of a selected frequency from aperture center to aperture center.

7. The speaker device as in claim 1 wherein the rigid emitter plate is convex to disperse wave output.

8. The speaker device as in claim 1 wherein the rigid emitter plate is concave to focus wave output.

9. The speaker device as in claim 1 wherein the apertures are between 0.050 and 0.600 inches in diameter.

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10. The speaker device as in claim 1 wherein the biasing pressure in the pressure means is between approximately 0 and 20 pounds per square inch.

11. The speaker device as in claim 1 further comprising a pressure seal around a perimeter of the piezoelectric film, wherein the pressure seal is used as the electrical contact means to drive the piezoelectric film.

12. The speaker device as in claim 1 wherein the piezoelectric film thickness is approximately 9 microns, aperture diameter is approximately 0.160 inches, and the biasing pressure is approximately 5 pounds per square inch, wherein a resonant frequency of approximately 35kHz is produced.

13. The speaker device as in claim 1 wherein the piezoelectric film thickness is approximately 12 microns, aperture diameter is approximately 0.168 inches, and the biasing pressure is approximately 6 pounds per square inch, wherein a resonant frequency of approximately 35kHz is produced.

14. The speaker device as in claim 1 wherein the piezoelectric film thickness is less than 25 microns, aperture diameter is less than 0.200 inches and the biasing pressure is less than 12 pounds

per square inch, wherein a resonant frequency of approximately 35kHz to 60kHz is produced.

15. The speaker device as in claim 1 further comprising a clamping member to clamp the piezoelectric film to the rigid emitter plate, wherein the clamping member has a plurality of clamping apertures which correspond to the plurality of apertures in the emitter face.

16. The speaker device as in claim 1 further comprising a generally hollow drum having a sidewall and a first and second opposing means, wherein the rigid emitter plate is attached to the first end of the drum and the inner face is disposed toward an interior cavity of the drum.

17. The speaker device as in claim 16 wherein the pressure means is coupled to the drum for developing a positive biasing pressure with respect to the thin film at the apertures.

18. The speaker device as in claim 1, further comprising:

an ultrasonic frequency generating means for supplying an ultrasonic signal to the piezoelectric film;

a sonic frequency generating means for supplying a sonic signal which is to be modulated onto the ultrasonic signal;

modulating means coupled to the ultrasonic frequency generating means and the sonic frequency generating means to develop an ultrasonic carrier wave with modulated sonic wave; and

transmission means coupled to the modulating means for supplying the carrier wave and modulated sonic wave to the piezoelectric film for stimulating generation of corresponding compression waves at the emitter plate.

~~19~~. A speaker device for emitting subsonic, sonic or ultrasonic compression waves, said device being comprised of:

a generally hollow drum having a sidewall and first and second opposing ends;

a rigid emitter plate attached to the first end of the drum, said plate having an outer face oriented away from the drum and an inner face disposed toward an interior cavity of the drum, said emitter plate having a plurality of apertures extending between the outer and inner faces;

a thin piezoelectric film disposed across the apertures of the emitter plate;

electrical contact means coupled to the piezoelectric film for providing an applied electrical input;

pressure means coupled to the drum for developing a biasing pressure with respect to the thin film at the apertures to distend the film into an arcuate emitter configuration capable of constricting and extending in response to variations in the applied electrical input at the piezoelectric film to thereby create a compression wave in a surrounding environment; and

a wave reinforcement structure disposed inside the interior cavity of the drum, and spaced a distance from the piezoelectric film to enhance a selected frequency.

20. The speaker device as in claim 19 wherein the wave reinforcement structure is disposed at the second opposing end of the drum.

21. The speaker device as in claim 19 wherein the wave reinforcement structure is a distance from the piezoelectric film selected from the group of distances consisting of 1/4, 1/2 and 1 wavelength of the selected frequency from the piezoelectric film.

22. The speaker device as in claim 19 wherein the wave reinforcement structure is a distance from the piezoelectric film selected from the group of distances consisting of 1/4, 1/2 and 1 wavelength of the carrier frequency from the piezoelectric film.

23. The speaker device as in claim 19 wherein the wave reinforcement structure is a distance from the piezoelectric film selected from the group of distances consisting of 1/4, 1/2 and 1 wavelength of the resonant frequency from the piezoelectric film.

24. The speaker device of claim 19 wherein the wave reinforcement structure is curved.

25. The speaker device as in claim 19, further comprising:

an ultrasonic frequency generating means for supplying an ultrasonic signal to the piezoelectric film;

a sonic frequency generating means for supplying a sonic signal which is to be modulated onto the ultrasonic signal;

modulating means coupled to the ultrasonic frequency generating means and the sonic frequency generating means to develop an ultrasonic carrier wave with modulated sonic wave; and

transmission means coupled to the modulating means for supplying the carrier wave and modulated sonic wave to the piezoelectric film for stimulating generation of corresponding compression waves at the emitter plate.

26. A speaker device for emitting subsonic, sonic or ultrasonic compression waves, said device being comprised of:

a rigid emitter plate having an outer face oriented outward and an inner face, said emitter plate having a plurality of apertures extending between the outer and inner faces, and having a shape;

wherein the aperture shape is selected from the group comprising rectangular and oval apertures, and having a lengthwise axis;

a thin isotropic piezoelectric film disposed across the apertures of the emitter plate such that an axis of mechanical stress is perpendicular to the lengthwise axis of the aperture shape;

electrical contact means coupled to the piezoelectric film for providing an applied electrical input; and

pressure means coupled to the emitter plate for developing a biasing pressure with respect to the thin film at the apertures to distend the film into an arcuate emitter configuration capable of constricting and extending in response to variations in the applied electrical input at the piezoelectric film to thereby create a compression wave in a surrounding environment.

27. A speaker device for emitting subsonic, sonic or ultrasonic compression waves, said device being comprised of:

a rigid emitter plate having an outer face oriented outward and an inner face, said emitter plate having a plurality of apertures extending between the outer and inner faces;

a thin piezoelectric film disposed across the apertures of the emitter plate;

at least two electrodes coupled to the piezoelectric film for providing an applied electrical input; and

pressure means coupled to the emitter plate for developing a biasing pressure with respect to the thin film at the apertures to distend the film into an arcuate emitter configuration capable of constricting and extending in response to variations in the applied electrical input at the piezoelectric film to thereby create a compression wave in a surrounding environment.

28. The speaker device as in claim 27 wherein the at least two electrodes are on separate edges of the piezoelectric film, wherein the electrodes can be used to independently control separate regions of the piezoelectric film.

29. The speaker device is in claim 27 wherein the at least two electrodes are at least two concentric rings.

30. The speaker device as in claim 27 further comprising a generally hollow drum having a sidewall and a first and second opposing means, wherein the rigid emitter plate is attached to the first end of the drum and the inner face is disposed toward an interior cavity of the drum.

31. The speaker device as in claim 27 wherein the pressure means is coupled to the drum for developing a positive biasing pressure with respect to the thin film at the apertures.

32. The speaker device as in claim 27, further comprising:

an ultrasonic frequency generating means for supplying an ultrasonic signal to the piezoelectric film;

a sonic frequency generating means for supplying a sonic signal which is to be modulated onto the ultrasonic signal;

modulating means coupled to the ultrasonic frequency generating means and the sonic frequency generating means to develop an ultrasonic carrier wave with modulated sonic wave; and

transmission means coupled to the modulating means for supplying the carrier wave and modulated sonic wave to the piezoelectric film for stimulating generation of corresponding compression waves at the emitter plate.

33. A speaker device for emitting subsonic, sonic or ultrasonic compression waves, said device being comprised of:

a rigid emitter plate, having an outer face and a plurality of emitter cells formed into the emitter plate, wherein each emitter cell has a separate pressure cavity and an aperture through the outer face;

a thin piezoelectric film disposed across the apertures of the emitter plate;

a plurality of tubes, interconnecting the emitter cells;

electrical contact means coupled to the piezoelectric film for providing an applied electrical input; and

pressure chamber means coupled the plurality of tubes for developing a biasing pressure with respect to the thin piezoelectric film at the apertures to distend the film into an arcuate emitter configuration capable of constricting and extending in response to variations in the applied electrical input at the piezoelectric film to thereby create a compression wave in a surrounding environment.

34. A method for sealing piezoelectric film to avoid gas transfer through the piezoelectric film, comprising:

(a) providing a piezoelectric film; and

(b) bonding a thin polymer coating onto at least one side of the piezoelectric film to seal the piezoelectric film and prevent gasses from passing through the film.

35. The method as in claim 34 further comprising the step of applying electrodes over the thin polymer coating and the piezoelectric film.

36. The method as in claim 34 further comprising the step of applying electrodes over the piezoelectric film before the thin polymer coating is bonded.

37. The method as in claim 34 wherein the thin polymer is a polyvinylidene chloride (PVDC) layer.

38. The method as in claim 34 wherein the piezolectric film is polyvinylidiene di-fluoride (PVDF).

39. The method as in claim 37 wherein the step of applying polyvinylidene chloride (PVDC) further comprises using a step selected from the group comprising brushing, air brushing, and dipping.

40. The method of claim 34 wherein step (c) further comprises the step of applying the electrodes in a selected pattern over the PVDC layer and the piezoelectric film to avoid areas which should not be electrically driven.

41. A speaker device for emitting subsonic, sonic or ultrasonic compression waves, said device being comprised of:

a rigid emitter plate having an outer face oriented outward and an inner face, said emitter plate having a plurality of apertures extending between the outer and inner faces;

a thin piezoelectric film disposed across the apertures of the emitter plate;

electrical contact means coupled to the piezoelectric film for providing an applied electrical input; and

pressure means coupled to the rigid emitter plate for developing a positive biasing pressure with respect to the thin film at the apertures to distend the film into an arcuate emitter configuration capable of constricting and extending in response to variations in the applied electrical input at the piezoelectric film to thereby create a compression wave in a surrounding environment.

42. A speaker device as in claim 41 wherein the thin piezoelectric film is disposed on the inner face, under the apertures of the emitter plate.

43. The speaker device as in claim 41 further comprising a thin polymer coating on the piezoelectric film, wherein the thin

polymer coating seals the piezoelectric film and prevents pressure leakage.

44. The speaker device as in claim 43 wherein the thin polymer coating is polyvinylidelene chloride (PVDC).

45. The speaker device as in claim 41 further comprising a heavy inert gas in the pressure means, wherein the heavy inert gas reduces gas leakage through the piezoelectric film.

46. The speaker device as in claim 45 wherein the heavy inert gas is nitrogen.

47. The speaker device as in claim 41 wherein the apertures have a center and the apertures are spaced apart 1/4 to 1/2 of a wavelength of a selected frequency from aperture center to aperture center.

48. The speaker device as in claim 41 wherein the rigid emitter plate is convex to disperse wave output.

49. The speaker device as in claim 41 wherein the rigid emitter plate is concave to focus wave output.

50. The speaker device as in claim 41 wherein the apertures are between 0.050 and 0.600 inches in diameter.

51. The speaker device as in claim 41 wherein the positive biasing pressure in the pressure means is between approximately 0 and 20 pounds per square inch.

52. The speaker device as in claim 41 wherein the piezoelectric film thickness is approximately 9 microns, aperture diameter is approximately 0.160 inches, and the positive biasing pressure is approximately 5 pounds per square inch, wherein a resonant frequency of approximately 35kHz is produced.

53. The speaker device as in claim 41 wherein the piezoelectric film thickness is approximately 12 microns, aperture diameter is approximately 0.168 inches, and the positive biasing pressure is approximately 6 pounds per square inch, wherein a resonant frequency of approximately 35kHz is produced.

54. The speaker device as in claim 41 wherein the piezoelectric film thickness is less than 25 microns, aperture diameter is less than 0.600 inches and the biasing pressure is less than 12 pounds

per square inch, wherein a resonant frequency of approximately 35kHz to 60kHz is produced.

55. The speaker device as in claim 41 further comprising a clamping member to clamp the piezoelectric film to the rigid emitter plate, wherein the clamping member has a plurality of clamping apertures which correspond to the plurality of apertures in the emitter face.

56. A speaker device as in claim 41 further comprising a wave reinforcement structure disposed inside the interior cavity of the drum, and spaced a distance from the piezoelectric film to enhance a selected frequency.

57. The speaker device as in claim 56 wherein the wave reinforcement structure is disposed at the second opposing end of the drum.

58. The speaker device as in claim 56 wherein the wave reinforcement structure is a distance from the piezoelectric film selected from the group of distances consisting of 1/4, 1/2 and 1 wavelength of the selected frequency from the piezoelectric film.

59. The speaker device as in claim 56 wherein the wave reinforcement structure is a distance from the piezoelectric film selected from the group of distances consisting of 1/4, 1/2 and 1 wavelength of the carrier frequency from the piezoelectric film.

60. The speaker device as in claim 56 wherein the wave reinforcement structure is 1/4 of a wavelength of the carrier frequency from the piezoelectric film.

61. The speaker device as in claim 56 wherein the wave reinforcement structure is a distance from the piezoelectric film selected from the group of distances consisting of 1/4, 1/2 and 1 wavelength of the resonant frequency from the piezoelectric film.

62. The speaker device as in claim 56 wherein the wave reinforcement structure is 1/4 of a wavelength of the resonant frequency from the piezoelectric film.

63. The speaker device of claim 56 wherein the wave reinforcement structure is curved.

64. The speaker device as in claim 41, further comprising:

an ultrasonic frequency generating means for supplying an ultrasonic signal to the piezoelectric film;

a sonic frequency generating means for supplying a sonic signal which is to be modulated onto the ultrasonic signal;

modulating means coupled to the ultrasonic frequency generating means and the sonic frequency generating means to develop an ultrasonic carrier wave with modulated sonic wave; and

transmission means coupled to the modulating means for supplying the carrier wave and modulated sonic wave to the piezoelectric film for stimulating generation of corresponding compression waves at the emitter plate.

65. A speaker device for emitting subsonic, sonic or ultrasonic compression waves, said device being comprised of:

a generally hollow drum having a sidewall and first and second opposing ends;

a rigid emitter plate attached to the first end of the drum, said plate having an outer face oriented away from the drum and an inner face disposed toward an interior cavity of the drum, said emitter plate having a plurality of apertures extending between the outer and inner faces;

a thin piezoelectric film disposed across the apertures of the emitter plate;

electrical contact means coupled to the piezoelectric film for providing an applied electrical input; and

pressure means coupled to the drum for developing a negative biasing pressure with respect to the thin film at the apertures to distend the film into an arcuate emitter configuration capable of constricting and extending in response to variations in the applied electrical input at the piezoelectric film to thereby create a compression wave in a surrounding environment.

66. A speaker device as in claim 65 wherein the thin piezoelectric film is disposed on the outer face, over the apertures of the emitter plate.

67. A system for indirectly generating at least one new sonic or subsonic frequency from at least two ultrasonic frequencies of different value, said system comprising:

a rigid emitter plate having an outer face oriented outward and an inner face, said emitter plate having a plurality of apertures extending between the outer and inner faces;

a thin piezoelectric film disposed across the apertures of the emitter plate;

pressure means coupled to the emitter plate for developing a biasing pressure with respect to the thin film at the apertures to distend the film into an arcuate emitter configuration capable of constricting and extending in response to variations in the applied electrical input at the piezoelectric film to thereby create a compression wave in a surrounding environment; and

electrical contact means coupled to the piezoelectric film for developing a vibration response at the plurality of apertures and associated arcuate emitter elements, wherein the vibrations operate as an ultrasonic frequency emitter for concurrently propagating (i) a first ultrasonic frequency and (ii) a second ultrasonic frequency which interacts with the first ultrasonic frequency to propagate a difference frequency within a sonic bandwidth.

68. The system as in claim 67 wherein the electrical contact means includes a modulating means coupled to the membrane to thereby supply the electrical signals for generating the first and second ultrasonic frequencies as modulated output of an input ultrasonic frequency and sonic frequency, said first and second ultrasonic frequencies having a difference in value equal to the at least one new sonic or subsonic frequency.